

WHAT IS CLAIMED IS:

1. A method of detecting an outer boundary of an iris from an image of an eye, the method comprising:

providing data representing an image of an eye comprising an image of the iris of the eye, the iris image being substantially annular and defined between inner and outer boundaries, the eye image comprising a plurality of pixels, the eye image data comprising location information and image information for each pixel of the eye image;

providing location information of the inner boundary of the iris image;

comparing the image information of a pixel on the inner boundary with the image information of pixels of the eye image; and

determining a pixel is on the outer boundary of the iris image when a difference between the image information of that pixel and the image information of the pixel on the inner boundary becomes a maximum among differences of the image information.

2. The method of Claim 1, wherein the location information of the inner boundary is obtained with use of a Canny edge detection method.

3. A method of obtaining an iris pattern, comprising:

providing an image of an iris of an eye, the iris image being substantially annular and defined between inner and outer boundaries;

obtaining data of a substantial portion, but not all, of the iris image; and

processing the data of the substantial portion to obtain an iris pattern.

4. The method of Claim 3, wherein the data comprises positional information and image information of a point within the portion.

5. The method of Claim 3, wherein the substantial portion of the iris image is from about 25% to about 95% of an area of the iris image.

6. The method of Claim 3, wherein the substantial portion of the iris image is from about 40% to about 85% of an area of the iris image.

7. The method of Claim 3, wherein the substantial portion of the iris image is from about 50% to about 75% of an area of the iris image.

8. The method of Claim 3, wherein the substantial portion of the iris image is from about 55% to about 65% of an area of the iris image.
9. The method of Claim 3, wherein the substantial portion of the iris image is substantially annular.
10. The method of Claim 3, wherein the substantial portion is annular and defined from the inner boundary to an imaginary closed line between the inner and outer boundaries.
11. The method of Claim 10, wherein the imaginary closed line is substantially parallel to the inner boundary.
12. The method of Claim 11, wherein a tangent at a point on the inner boundary is substantially parallel to a tangent at a point on the imaginary line that is on a line perpendicular to the tangent at the point on the inner boundary.
13. The method of Claim 3, wherein the substantial portion is annular and defined from an imaginary closed line between the inner and outer boundaries to the outer boundary.
14. The method of Claim 13, wherein the imaginary closed line is substantially parallel to the outer boundary.
15. The method of Claim 3, wherein the substantial portion is annular and defined between a first imaginary closed line and a second imaginary closed line, wherein the first imaginary line is drawn between the inner and outer boundaries, and wherein the second imaginary line is drawn between the first imaginary line and the outer boundary.
16. The method of Claim 15, wherein the first and second lines are substantially parallel to each other.
17. The method of Claim 3, wherein the substantial portion of the iris image is not annular.
18. The method of Claim 3, wherein the data of the substantial portion is transformed into a polar coordinate form.
19. A device for use with a iris pattern recognition system, comprising:
 - means for providing an image of an iris of an eye, the iris image being substantially annular and defined between inner and outer boundaries;
 - means for obtaining data of a substantial portion, but not all, of the iris image;
 - and

means for processing the data of the substantial portion to obtain an iris pattern.

20. An iris image processing device, comprising:

an input device configured to receive an image of an eye comprising an image of an iris of an eye, the iris image being substantially annular and defined between inner and outer boundaries;

a first circuit configured to identify data of the iris image from the image of the eye; and

a second circuit configured to process the iris image data so as to obtain data of a substantial portion, but not all, of the iris image for further processing.

21. The device of Claim 20, wherein the first and second circuits are integrated in a circuit board or a chip.

22. A security system using iris pattern recognition, comprising:

an input device configured to receive an image of an eye comprising an image of an iris of an eye, the iris image being substantially annular and defined between inner and outer boundaries;

a first circuit configured to identify data of the iris image from the image of the eye;

a second circuit configured to process the iris image data so as to obtain data of a substantial portion, but not all, of the iris image for further processing; and

a third circuit configured to process the data of the substantial portion of the iris image so as to determine whether the data of the iris image matches a pre-registered data.

23. A method of processing a iris image, comprising:

providing data of an original image of an iris; and

producing at least one modified iris image data with use of the data of the original iris image, the modified iris image data representing an iris image that is rotated by an angle about a point on the original image.

24. The method of Claim 23, wherein the point of rotation is located at a substantially central position of the original image of the iris.

25. The method of Claim 23, further comprising processing the original iris image data to determine whether the original iris image data matches a pre-registered iris image data.

26. The method of Claim 23, further comprising processing the modified iris image data to determine whether the modified iris image data matches a pre-registered iris image data.

27. The method of Claim 23, wherein the modified iris image data represents an iris image that is rotated in a clockwise direction.

28. The method of Claim 23, wherein the modified iris image data represents an iris image that is rotated in a counter-clockwise direction.

29. The method of Claim 23, wherein a plurality of modified iris image data are produced.

30. The method of Claim 23, wherein the modified iris image data is processed in accordance with a wavelet transform method.

31. The method of Claim 23, wherein the original iris image data is processed in accordance with a wavelet transform method.

32. An iris image processing device, comprising:
means for providing data of an original image of an iris; and
means for producing at least one modified iris image data based on the data of the original iris image, the modified iris image data representing an iris image that is rotated by an angle about a point on the original image.

33. The device of Claim 32, further comprising:
means for determining whether the modified iris image data matches a pre-registered data.

34. An iris image processing device, comprising:
an input device configured to receive an image of an eye comprising an image of an iris of an eye;
a first circuit configured to identify data of the iris image from the image of the eye; and

a second circuit configured to process the iris image data so as to produce at least one modified iris image data based on the data of the original iris image, the modified iris image data representing an iris image that is rotated by an angle about a point on the original image.

35. A security system using iris pattern recognition, comprising:

the iris image processing device of Claim 34; and

a third circuit configured to process the modified iris image data to determine whether the modified iris image data matches a pre-registered data.